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(54) Ribbon cassette

(57) A ribbon cassette enables information regarding the type of ribbon in the cassette, the end of the ribbon, the supply of ribbon and disturbances in the ribbon feed to be derived in a simple manner. For this purpose, the ribbon cassette contains a rotational member (4, 26) which is connected to the core (2) of the ribbon supply spool (3) for rotation therewith and which bears holes (17) or markings (22, 23) which have a specific form according to the type of ribbon present on the ribbon supply spool (3) and can be read by means of a sensor arrangement (19, 21, Figure 2 not shown). The ribbon cassette further comprises a two-armed lever (9) pivotally mounted in the cassette housing (1), having first and second lever arms (6, 10) which engage teeth on the edge of the rotational member (4, 26) when the two-armed lever (9) is in a first end condition and a second end condition respectively.

Fig. 1

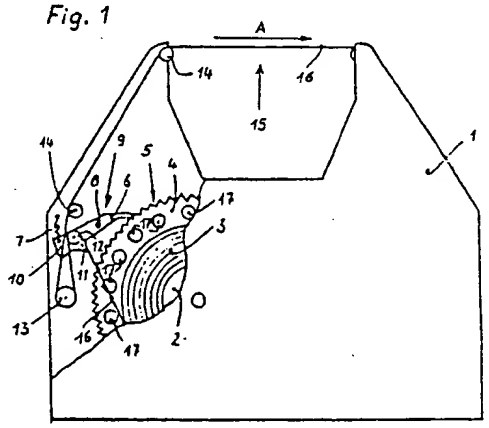

Fig. 3b

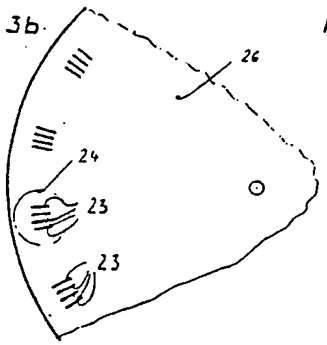

Fig. 3a

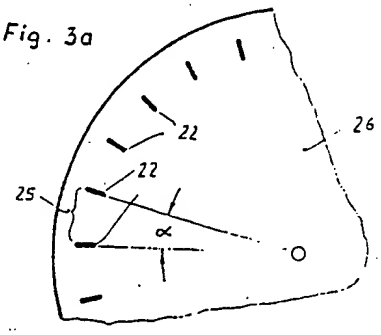

Fig. 1

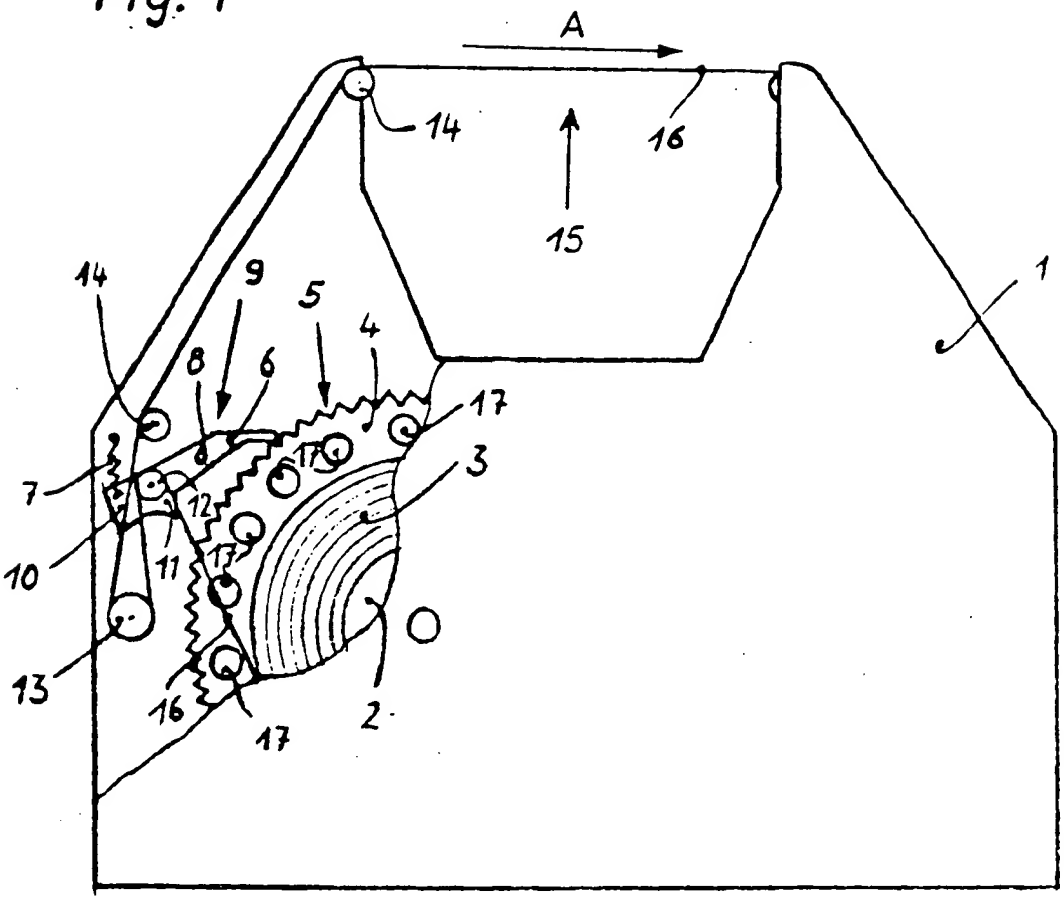

Fig. 2

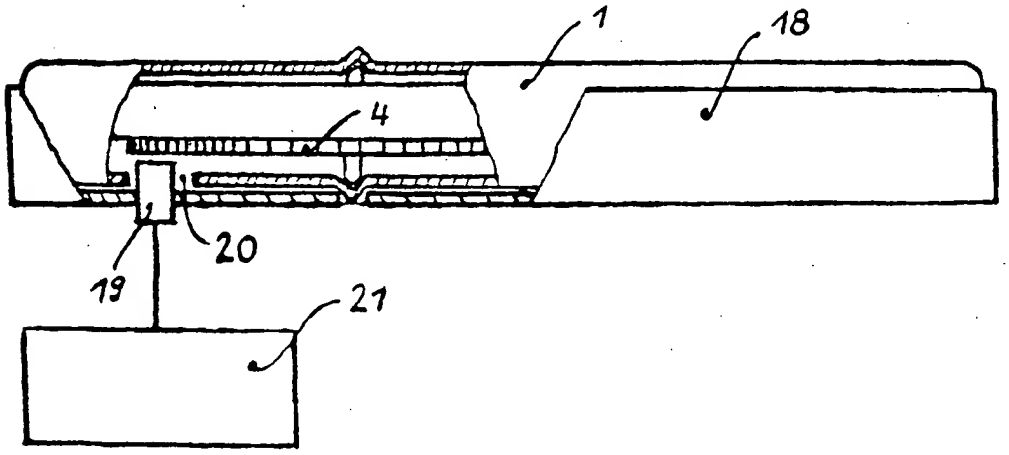

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Fig. 3a

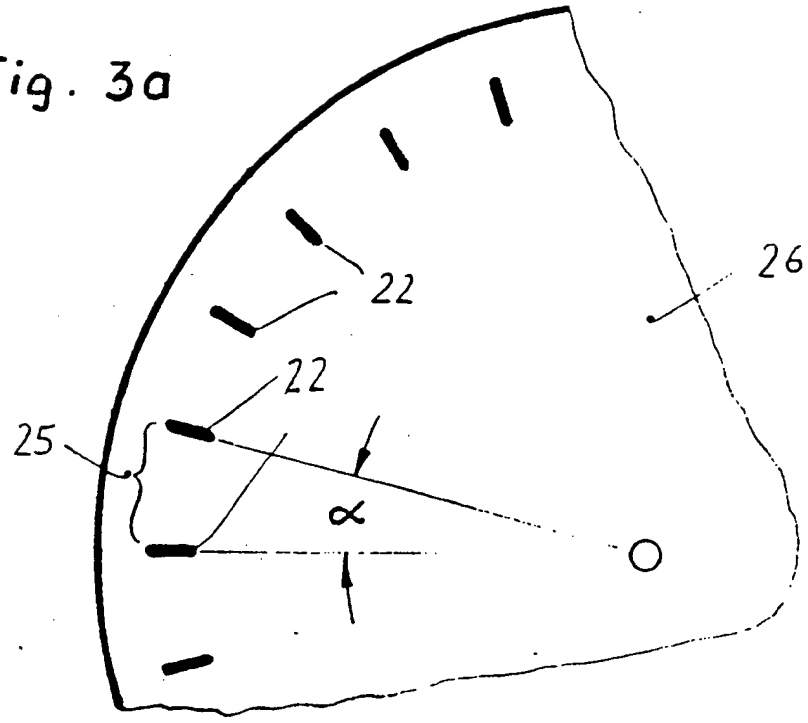
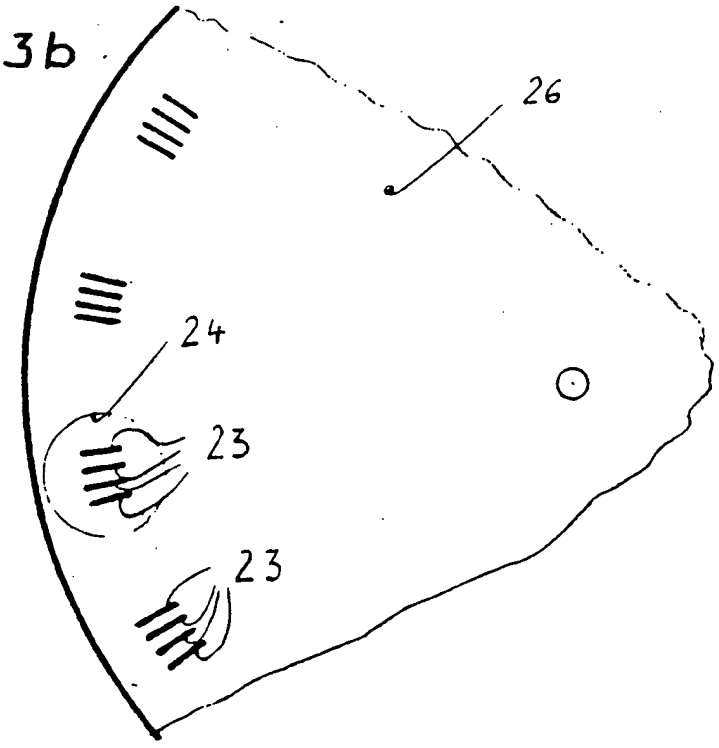


Fig. 3b



SPECIFICATION

Ribbon cassette

This invention relates to a ribbon cassette for typewriters or similar business machines.

In such equipment, ribbon cassettes with different ribbons such as carbon C ribbons, multi-carbon ribbons, textile ribbons, ribbons of different colour etc. are used to carry out different tasks. Now, depending on the type of ribbon used, in order to ensure optimum utilization of the ribbon used in each case, a certain length of ribbon must be advanced before each impression of a character. For this reason, it is necessary to adjust the programmable control unit, which is usually present in such equipment and which controls the ribbon advance for the type of ribbon used. Also, it is desirable, particularly when switching on, to provide the operator with an indication of the typed ribbon in the machine.

Furthermore, in so-called memory-type typewriters or in output printers for data processing equipment – since unsupervised operation is possible with such equipment – it is necessary that the equipment should be switched off automatically on reaching the end of the ribbon or in the event of disturbances in the ribbon feed. Apart from this automatic ribbon monitoring, an indication of the residual capacity of the ribbon is helpful, so that the operator can estimate, before the start of a printing task, whether the ribbon still available is sufficient to carry out the printing task.

In order to overcome the above-mentioned problems, it is necessary to derive a large number of items of information from the ribbon cassette for evaluation. It is therefore the object of the present invention to develop a ribbon cassette from which the plurality of different items of information can simply, and cheaply, be obtained.

According to the present invention there is provided a ribbon cassette for a typewriter or other printing machine, comprising:

a housing;

a ribbon supply spool having a core and being rotatably mounted in said housing by said core;

ribbon guide elements for guiding ribbon from said ribbon supply spool past an impression region situated outside the housing and back into the housing;

a rotational member connected to the core of the ribbon supply spool for rotation therewith, said member having marking means on at least one face thereof;

and at least one aperture located in said cassette housing such that said marking means disposed on the rotational member can be scanned by means of a sensor device, on rotation of said ribbon supply spool.

The invention also includes a typewriter or other printing machine having a ribbon cassette as defined in the last preceding paragraph, said machine having a sensor device for scanning said marking means and means for determining from said scanning at least one characteristic out of the type of ribbon, the end of the ribbon, the amount of ribbon in the ribbon supply spool and disturbances in the ribbon feed.

Preferably, said rotational member of the ribbon cassette is arranged to be locked to prevent said spool from rotating, when the end of the ribbon is reached or disturbance in the ribbon feed occurs.

Preferably said rotational member is a spool support, and:

the spool support comprises teeth at its edge;

a two-armed lever having a first lever arm and a second lever arm is pivotally mounted in the cassette housing such that said first lever arm engages the teeth of the spool support, and thus locks the spool support, when said lever is in a first end condition and said second lever arm engages the teeth of the spool support, and thus locks the spool support, when said lever is in a second end condition;

said two-armed lever is urged towards its first end condition by the action of a spring;

and a ribbon guide element is disposed on the second lever arm of the two-armed lever such that tension in the ribbon urges the two-armed lever to pivot about its pivot pin towards its second end condition, against the force of the spring.

Said marking means may be suitable for optical, mechanical or inductive scanning, and may form at least one ring comprising a plurality of holes in equally spaced relationship around said rotational member.

The spacing between said holes may depend on the type of ribbon in the cassette.

Alternatively, said marking means may comprise a plurality of markings disposed over a circular path around the rotational member and grouped together into code groups.

In order that the invention may be well understood, an embodiment thereof, which is given by way of example only, will now be described, reference being made to the accompanying drawings, in which:

Figure 1 shows a ribbon cassette;

Figure 2 shows the ribbon cassette of Figure 1 in a receiving device disposed in the machine; and

Figures 3a and *3b* each illustrate part of a rotational member provided with markings.

A ribbon cassette is illustrated in Figure 1. The broken-away portion at the left-hand side of the cassette housing 1 gives a view of the most important elements of the ribbon cassette.

On a spool core 2 there is the supply spool 3 of ribbon which rests on a spool support 4, which is a rotational member connected to the spool core 2 for rotation therewith. The spool support 4, which is provided with circular holes 17, has teeth 5 at its front face. A first lever arm 6 of a two-armed lever 9 engages the teeth 5, and the two-armed lever 9 is subject to the action of a spring 7 and pivotally mounted in the cassette housing 1 by means of a pin 8. Formed on the second lever arm 10 of the two-armed lever 9 is a pawl 11 which can be

brought into engagement with the teeth 5 of the spool support 4 by pivoting the two-armed lever 9 against the action of the spring 7. The ribbon 16 leads from the ribbon supply roll 3, over a first ribbon guide roller 12, which is rotatably mounted on the second lever arm 10 of the two-armed lever 9, to a second ribbon guide roller 13 which is rotatably mounted in the cassette housing 1. From there, the ribbon 16, guided by further ribbon guide elements 14, reaches an impression region 15 situated outside the cassette housing 1, and finally leads back into the cassette housing 1 where it is wound on to a ribbon spool (not illustrated) by means of a ribbon feed device (not illustrated) – for example such as is known from German Patent DE 25 53 329. Such ribbon feed devices are constructed so that they advance a constant amount of ribbon during each ribbon feed step.

The ribbon feed device (not illustrated) advances the ribbon 16 in the direction of the arrow A, when driven by a driving mechanism (not illustrated). Since the spool support 4 of the ribbon supply spool 3 is at first locked by the first lever arm 6 of the two-armed lever 9 in such a first end condition, the first lever arm 6 engaging in the teeth 5 of the spool support 4, the tension in the ribbon 16 increases. This tension has the effect of deflecting the two-armed lever 9 against the force of the spring 7, so that the first lever arm 6 of the two-armed lever 9 releases the spool support 4. Thus the ribbon 16 can move unhindered in the direction of the arrow A. If no more movement of the ribbon 16 takes place, the tension in the ribbon 16 decreases and the two-armed lever 9 swings back into its initial position so that the first lever arm 6 again locks the spool support 4. Thus, the ribbon 16 remains constantly tensioned and the spool support cannot turn accidentally.

Now when the ribbon 16 is completely unwound from the ribbon supply spool 3 and the ribbon feed device continues to advance ribbon, the two-armed lever 9 is deflected by the ever increasing tension in the ribbon 16, against the force of the spring 7, to a second end condition, wherein the pawl 11 formed on the second lever arm 10 of the two-armed lever 9 engage the teeth 5 of the spool support 4 and thus locks the spool support 4. The reason for this locking is explained fully below.

Figure 2 shows a ribbon cassette as shown in Figure 1, which is inserted in a receiving device 18 disposed at the side of the machine. The region shown broken away in Figure 2 allows a sensor 19 to be seen which is secured to the receiving device 18 and projects into the ribbon cassette through an aperture 20 in the cassette housing 1. The sensor 19, which may be constructed in the form of, for example, a reflex light barrier, is disposed such that holes 17 (Figure 1) in the spool support 4 can be scanned by means of the sensor 19 when the spool support rotates. The scanning is effected, for example, by clock-pulse-controlled interrogation of the sensor 19 by means of a programmable control unit 21. Such programmable control units are generally known; it is usually a question of at least one microprocessor with a ROM store containing the control program and a RAM store receiving the variable data.

Before describing how information is obtained by scanning the holes 17, enabling recognition of the type of ribbon, the end of the ribbon, the supply of ribbon remaining on the ribbon supply spool and disturbances in the ribbon feed, using only one sensor, some general remarks first appear necessary.

As stated with reference to Figure 1, the spool support 4 of the ribbon supply spool 3 is provided with circular holes 17. The type of ribbon has to be determinable by scanning these holes 17 and in addition, the end of the ribbon, the remaining supply of ribbon and disturbances in the ribbon feed have to be detected. In order to make this possible, the arrangement of the holes 17 must satisfy two conditions:

1) The holes 17 must define a marking from the scanning of which the type of ribbon can be determined.

2) Each two adjacent holes 17 must define a known angle of rotation so that the remaining supply of ribbon can be determined by a comparison of the number of ribbon feed steps carried out during rotation through this angle with stored or calculated values, and the end of the ribbon or disturbances in the ribbon feed detected when a stored or calculated limiting value is exceeded.

The conditions listed above are formulated with reference to the example of Figure 1. In general, this formulation means that

– a rotational member connected to the core 2 of the ribbon supply spool 3 for rotation therewith bears markings, the form of which is selected depending on the type of ribbon on the ribbon supply spool 3 so that it is possible to determine the type of ribbon by scanning the markings;

– a known angle of rotation is defined by the markings themselves and alternatively or additionally the gap between (preferably adjacent) markings so that the remaining supply of ribbon can be determined by a comparison of the number of ribbon feed steps carried out during rotation through this angle with stored or calculated values and the end of the ribbon or disturbances in the ribbon feed detected when a stored or calculated limiting value is xceeded.

From the generalization of the conditions it will be seen that the form of the markings is not tied to the angle of rotation which is formed by each two adjacent holes 17 as in the example of Figure 1. This will be gone into in more detail below.

In the embodiment shown in Figure 1, the first condition is fulfilled in that th markings for recognizing the type of ribbon are defined by the angle of rotation formed by each two adjacent holes. As a result of thus fixing the angle of rotation between adjacent holes, the second condition is automatically fulfilled.

The conditions for recognition of the type of ribbon, of the end of the ribbon, of the supply of ribbon and of disturbances in the ribbon feed having now been made clear, the mode of operation will now be described in more detail.

Recognition of the type of ribbon

After each switching on of the machine or after a change of ribbon, which can be recognized, for example by means of a so-called cover switch, the programmable control unit 21, by appropriate actuation of the drive for the ribbon feed mechanism, causes this to advance a certain length of ribbon, for example that necessary for carbon C ribbons, during each drive step. At the same time, the programmable control unit 21 interrogates the sensor 19 cyclically. When a hole 17 passes the sensor 19, a signal appears at the sensor output. On detecting the signal, the programmable control unit 21 starts a counter which is incremented by one with each actuating pulse for the drive of the ribbon feed mechanism. When the next hole 17 passes the sensor 19, a signal again appears at the sensor output. On detecting this signal, the programmable control unit 21 compares the value of the counter contents with values stored under various addresses. When coincidence is found for a value within a preset range, the programmable control unit initialises a control sequence through the address of this value, which control sequence determines the actuating signals for the drive of the ribbon feed mechanism so that a length of ribbon specific to the type of ribbon is advanced on each drive step, and, possibly, indicates the type of ribbon inserted by appropriate actuation of a display device.

When the type of ribbon is identified by the method described above, it must be borne in mind, with regard to determining the angle of rotation between two adjacent holes 17, that the length of ribbon advanced during rotation through that angle depends on the diameter of the roll. This means that a large diameter roll produces a different counter content between two successive sensor signals to a small diameter roll. From this it follows that the angles of rotation for the identification of the different types of ribbon have to be selected so that the particular counter content permits unambiguous identification. Therefore, in selecting the angles of rotation; conditions such as the following must be satisfied:

$Z_{min\ I}$ is greater than $Z_{max\ II}$
$Z_{min\ II}$ is greater than $Z_{max\ III}$
$Z_{min\ III}$ is greater than $Z_{max\ IV}$, and so on;

where:

$Z_{min\ I}$ denotes the minimum counter content for ribbon type 1
$Z_{min\ II}$ denotes the minimum counter content for ribbon type 2
$Z_{min\ III}$ denotes the minimum counter content for ribbon type 3
$Z_{max\ II}$ denotes the maximum counter content for ribbon type 2
$Z_{max\ III}$ denotes the maximum counter content for ribbon type 3
$Z_{max\ IV}$ denotes the maximum counter content for ribbon type 4

Recognition of the remaining ribbon supply

During the operation of the machine, the programmable control unit 21 advances a certain length of ribbon which is specific to the type of ribbon by appropriate actuation of the drive for the ribbon feed mechanism, and at the same time cyclically interrogates the sensor 19. When a hole 17 passes the sensor 19, a signal appears at the output of the sensor 19. When the programmable control unit detects this signal, it starts a counter which is incremented by one on each actuating step of the drive for the ribbon feed mechanism. When the next hole 17 passes the sensor 19, a signal again appears at the sensor output. This signal causes a comparison of the counter contents with values stored under various addresses to be carried out by the programmable control unit 21. The addresses of the values which are used for this comparison depend on the type of ribbon used, which is determined automatically by the programmable control unit 21 during previous recognition of the type of ribbon or is defined by an appropriate manual setting. When the programmable control unit 21 finds coincidence between the counter contents and a stored value within a preset range during this comparison, it initializes a control sequence which causes information corresponding to the remaining supply of ribbon to be displayed or updates a corresponding display as the case may be. After each comparison the programmable control unit 21 resets the counter and starts it afresh.

The above cycle can be carried out after each time the machine is switched on or after each change of ribbon without printing and must be constantly repeated during a printing operation so that information about the remaining supply of ribbon is present at every moment.

Recognition of the end of the ribbon or of disturbances in the ribbon feed

Recognition of the end of the ribbon or of disturbances in the ribbon feed is effected substantially in the same manner as recognition of the remaining supply of ribbon and so only the difference in the procedure will now be described.

When the end of the ribbon is reached or if the ribbon breaks, rotation of the ribbon supply spool ceases completely during the ribbon feed and if the ribbon is jammed, rotation is at least greatly inhibited. This circumstance can be utilized, within the framework of the method of recognizing the remaining supply of ribbon, in the sense that the counter started by the output of the signal from the sensor 19 is interrogated cyclically by means of the programmable control unit 21 for a maximum count which can be preset. When the counter reaches the maximum count, the programmable control unit 21 stops the further printout of characters and delivers a corresponding signal to the operator or to a connected computer as the case may be.

When th end of the ribbon is reached or rotation of the ribbon supply spool inhibited, the spool support 4

can be locked by means of the two-armed lever 9, as a result of the rise in tension in the ribbon 16, as already described above. Without this measure, when the end of the ribbon is reached or the ribbon supply spool jammed, the spool support 4 would execute oscillating movements. Thus if the sensor 19 was at the edge of a hole 17, it would deliver unwanted signals, and the end of the ribbon or jamming of the ribbon supply spool could not be detected. Locking the spool support 4 reliably prevents this.

It must be noted that the methods indicated above for the recognition of the type of ribbon, the remaining supply of ribbon, the end of the ribbon or disturbances in ribbon feed, it must also be noted that these are only given by way of example. This applies in particular to the recognition of the type of ribbon. The actual method of recognizing the type of ribbon depends primarily on the form of the markings. In order to make this clear, two basic starting points for the design of the markings are shown in Figures 3a and 3b.

The part of a rotational member 26 illustrated in Figure 3a – which may be the spool support 4 in Figure 1 – has marks 22 disposed over a circular path. The arrangement is such that each two adjacent marks 22 form a certain angle of rotation α. This angle of rotation α is selected so that the type of ribbon can be determined from the angle of rotation α, for example through the number of ribbon feed cycles necessary in order to turn the ribbon supply spool through this angle of rotation. In this case, the angle of rotation α represents the marking for the recognition of the type of ribbon.

The part of the rotational member 26 illustrated in Figure 3b – again it may be the spool support 4 in Figure 1 – likewise has marks 23 which are disposed over a circular path, but which are combined to form code groups 24. The code groups 24 indicate the type of ribbon in the form of a code and can be read directly by the programmable control unit 21 through the sensor 19. In this case, the code groups 24 form the marking.

Modifications or combinations of the possible formations of the markings shown in Figures 3a and 3b are familiar to the expert and therefore do not need any further explanation.

It should also be noted that other marks, than those such as marks 17, 22, 23, which can be scanned optically are conceivable, and the marks may be scanned on another physical principle (for example mechanical scanning, inductive scanning etc.). The fact that the scanning principal has an effect on the form of the markings is obvious. It should also be mentioned that the marks can obviously also be disposed over a plurality of circular paths. In this case a corresponding number of sensors must be provided for the scanning.

CLAIMS

1. A ribbon cassette for a typewriter or other printing machine, comprising:
a housing;
a ribbon supply spool having a core and being rotatably mounted in said housing by said core;
ribbon guide elements for guiding ribbon from said ribbon supply spool past an impression region situated outside the housing and back into the housing;
a rotational member connected to the core of the ribbon supply spool for rotation therewith, said member having markings means on at least one face thereof;
and at least one aperture located in said cassette housing such that said marking means disposed on the rotational member can be scanned by means of a sensor device, on rotation of said ribbon supply spool.

2. A ribbon cassette as claimed in claim 1, wherein said rotational member is lockable, to prevent said spool from rotating, when the end of the ribbon is reached.

3. A ribbon cassette as claimed in claim 1 or 2, wherein said rotational member is arranged to be locked, to prevent said spool from rotating, when disturbance in the ribbon feed occurs.

4. A ribbon cassette as claimed in any preceding claim, wherein the rotational member is a spool support.

5. A ribbon cassette as claimed in claim 4, wherein:
the spool support comprises teeth at its edge;
a two-armed lever having a first lever arm and a second lever arm is pivotally mounted in the cassette housing such that said first lever arm engages the teeth of the spool support, and thus locks the spool support, when said lever is in a first end condition and said second lever arm engages the teeth of the spool support, and thus locks the spool support, when said lever is in a second end condition;
said two-armed lever is urged towards its first end condition by the action of a spring;
and a ribbon guide element is disposed on the second lever arm of the two-armed lever such that tension in the ribbon urges the two-armed lever to pivot about its pivot pin towards its second end condition, against the force of the spring.

6. A ribbon cassette as claimed in any preceding claim, wherein said marking means is suitable for optical scanning.

7. A ribbon cassette as claimed in any one of claims 1 to 5, wherein said marking means is suitable for mechanical scanning.

8. A ribbon cassette as claimed in any one of claims 1 to 5, wherein said marking means is suitable for inductive scanning.

9. A ribbon cassette as claimed in any preceding claim, wherein said marking means forms at least one ring comprising a plurality of holes in equally spaced relationship around said rotational member.

10. A ribbon cassette as claimed in claim 9, wherein the spacing between said holes is dependant on the type of ribbon in the cassette

plurality of markings disposed over a circular path around the rotational member and grouped together into code groups.

12. A typewriter or other printing machine having a ribbon cassette as claimed in any one of the preceding claims, said machine having a sensor device for scanning said marking means and means for determining from said scanning at least one characteristic out of the type of ribbon, the end of the ribbon, the amount of ribbon in the ribbon supply spool and disturbances in the ribbon feed.

13. A ribbon cassette substantially as herein described with reference to Figures 1, 2 and either 3a or 3b of the accompanying drawings.

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